What Is Claimed Is:

1. An apparatus for detecting an analyte, comprising:

(a) an integrated circuit including a light detection system;

(b) a selectively permeable container attached to a substrate located on said integrated circuit;

(c) a layer of semiconducting material between said substrate and said container.

(d) a microorganism housed within said container wherein the microorganism metabolizes a selected analyte to emit light in response to a metabolite of said analyte;

(e) a semiconductive layer between the substrate and the container; and

(f) a fluid nutrient reservoir equipped with a microfluidic pump on said substrate.

2. The apparatus of claim 1 wherein the semiconductor layer is a metal oxide.

3. The apparatus of claim 2 wherein the metal oxide is a complementary metal oxide layer that includes a photodiode, a current to frequency converter, a digital counter, and a wireless transmitter.

4. The apparatus of claim 3 further comprising a central data collection station to receive transmissions from said transmitter.

5. The apparatus of claim 1 wherein the microorganism is *Pseudomonas fluorescens* HK44.

6. A biosensor for detection of ammonia, comprising:

an integrated circuit chip comprising a microorganism that metabolizes ammonia and which harbors a *lux* gene fused with a heterologous promoter gene stably incorporated into the chromosome of said microorganism wherein the microorganism is held sufficiently close to a light detection system located on the chip to detect light emitted by a *lux* gene product expressed in the presence of ammonia.

7. The biosensor of claim 6 wherein the microorganism is a bacterium that metabolizes ammonia and which is identified as *E. coli, Pseudomonas putida F1* or *Pseudomonas HK44*.

8. The biosensor of claim 7 wherein the bacterium is a nitrifying bacterium.

9. The biosensor of claim 8 wherein the nitrifying bacterium is a nitropseudomonad.

10. The biosensor of claim 9 wherein the nitrifying bacterium is *N. europaea*.

11. The biosensor of claim 6 wherein the *lux* fusion comprises *lux CDABC* genes fused with a promoter responsive to the presence of ammonia.

12. The biosensor of claim 11 wherein the promoter comprises a *hao* or *amo* promoter.

13. The biosensor of claim 6 wherein the microorganism is encapsulated in a light permeable material.

14. The biosensor of claim 13 wherein the light permeable material is an encapsulating matrix selected from the group consisting of polydimethylsiloxane, polyvinyl alcohol/polyvinylpryidine copolymer, latex copolymer, agar/agarose, carrageenan, polyacrylamide, alginate, polyurethane/polycarbonyl sulfonate, polyvinyl alcohol and silicon glass.

15. An apparatus comprising the biosensor of claim 6.

16. The biosensor of claim 7 wherein the microorganism is selected from the group consisting of *E. coli*, *Salmonella*, *Mycobacter tuberculosis*, *Listeria*, *Photobacter phosphoreum* or *Vibrio fischeri*.

17. A method for detecting the presence of ammonia, comprising contacting a sample suspected of containing ammonia with the biosensor of claim 6 and detecting the light emitted by the *lux* gene product that is induced by the presence of ammonia.

18. A biosensor for the detection of an estrogen, comprising a collection of eukaryotic cells harboring a recombinant lux gene from a high temperature microorganism wherein said gene is operably linked with a heterologous promoter and wherein a detectable light-emitting *lux* gene product is expressed in the presence of said estrogen.

19. The biosensor of claim 18 wherein the high temperature microorganism is bioluminescent.

20. The biosensor of claim 19 wherein the bioluminescent microorganism is *Xenorhabdus luminescens*, *Pseudomonas phosphoreum*, or *photobacterium phosphoreum*.

21. The biosensor of claim 18 wherein the estrogen is estrone, estradiol, estriol or an esterified estrogen.

22. An apparatus comprising the biosensor of claim 18.

23. The apparatus of claim 22 further comprising an integrated circuit chip on which the biosensor is located and wherein said chip comprises an integrated light detection system.

24. A method for the detection of an estrogen compound comprising contacting a sample suspected of containing an estrogen with the biosensor of claim 18 and detecting the presence of emitted light from a product expressed by the *lux* gene wherein said expression is induced in the presence of the estrogen compound.

25. The method of claim 24 wherein the emitted light is detected by the apparatus of claim 23.

26. A luminometer for the detection of an estrogen compound comprising the biosensor of claim 18 and an integrated chip that includes a photodetector wherein said eukaryotic cell collection is held on the integrated chip surface and responds to the presence of estrogen by expressing a bioluminescent protein from the *luxABCDE* gene wherein bioluminescence of said protein is detected by the photodetector.

27. The luminometer of claim 26 wherein the eukaryotic cell collection is encapsulated in a sol-gel matrix held on the integrated chip surface.

28. The luminometer of claim 27 wherein the sol-gel encapsulation matrix is selected from the group consisting of polydimethylsiloxane, polyvinyl alcohol/polyvinylpryidine copolymer, latex copolymer, agar/agarose, carrageenan,

polyacrylamide, alginate, polyurethane/polycarbonyl sulfonate, polyvinyl alcohol and silicon glass.

29. A luminometer for the detection of ammonium ion comprising:

an expression vector comprised within a transformed prokaryotic cell harboring a *lux* gene fused with a heterologous promoter gene stably incorporated into the chromosome of said cell wherein said gene expresses a bioluminescent protein in the presence of ammonia; and

an integrated circuit that comprises a photodetector to detect light emitted by said bioluminescent protein in the presence of ammonia.

30. The luminometer of claim 29 further comprising a current to frequency converter.

31. The luminometer of claim 30 further comprising a digital counter.

32. The luminometer of claim 31 further comprising a wireless transmitter.

33. An integrated microluminometer comprising an integrated circuit chip that includes a CMOS photodiode, a detector and an n-well/p-substrate junction arranged in an array of junctions across the detector active region.

34. The integrated microluminometer of claim 33 further comprising an analog integrator and a current-to-frequency converter.

35. A method of measuring bioluminescence, comprising:

contacting a modified bioluminescent microorganism that emits light in the presence of a selected analyte with a sample suspected of containing said analyte, operating the microluminometer of claim 34 at reduced bias and counting light pulses produced for a fixed time to determine photocurrent wherein said photocur-

rent is proportional to number of pulses that measure bioluminescence when said analyte causes the bioluminescent microorganism to emit light.